

NASA SBIR/STTR Technologies

High-Fidelity Predictions of Launch Vehicle Liftoff Acoustic Fields

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Identification and Significance of Innovation

Current computational models for space vehicle launch system severely lack practical feasibility in

- Describing the accurate physics of high-speed jet impingement noise generation mechanism
- Identification of critical noise components (Mach wave radiation, impingement tones, turbulent mixing etc.)
- Acoustic loading on heavy-lift vehicle payload section and prediction of noise metrics in the surrounding
- Practical simulation capabilities of complex flow-acoustic environment without significant prediction errors

Expected TRL Range at the End of Contract (1-9): 4

Technical Objectives

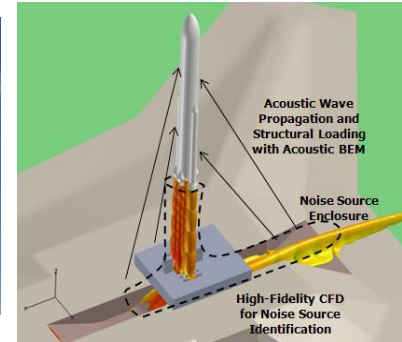
- Apply innovative concepts/tools for high-resolution description of both the noise source and acoustic environment with practical applicability for large-scale simulations

Work Plan

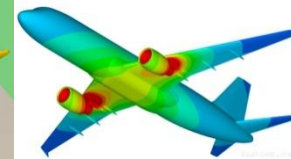
- High-fidelity characterization of rocket exhaust noise sources through LES/hybrid RANS-LES method in Loci-Chem and OVERFLOW software
- Extract the critical components of noise from the high-speed flowfield enclosing all acoustic source regions (plume exhaust and impingement zones, platform, trench etc.) and derive a model interface
- Non-dissipative acoustic loading predictions using FastBEM software on lift vehicle and noise radiation, intensity and directivity in the surrounding
- Model validations and application demonstration for accuracy and large-scale feasibility



**Launch Vehicle
Lift-off Environment**



**Combine Propulsion Flow CFD
with Acoustic Field Methods**



**FastBEM Predictions of
Vehicle Acoustic Loading**

NASA and Non-NASA Applications

- Heavy launch vehicle lift-off acoustic loading
- Jet noise predictions of commercial (traditional) and military (STOVL) aircrafts
- Airframe, landing gear, trailing edge noise
- Vibro-acoustics and noise control technologies
- Automobile noise

Firm Contacts

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